CONVERSATIONS

ON SOME LEADING POINTS IN

NATURAL PHILOSOPHY;

DESIGNED TO ILLUSTRATE

THE PERFECTIONS OF THE DEITY,

AND TO

EXPAND THE YOUTHFUL MIND:

BY THE REV. B. H. DRAPER.

Nature is but the name for an effect
Whose cause is God. He feeds the secret fire
By which the mighty process is maintained;
And his beneficence no charge exhausts.

COWPER.

FIRST AMERICAN EDITION.

UTICA:

WESTERN SUNDAY SCHOOL UNION.

J. COLWELL, PRINTER.

1828

ADVERTISEMENT.

The Writer of the following pages has long been a Parent; he thinks it of great importance to the happiness of youth, that they should be led early to see the hand of God, as it is displayed around them in the creation: he is confident, from his own experience, that such a view of things is a perpetual source of improvement and delight.

It is his design to awaken the minds of the young to correct thought, by presenting, in a familiar manner, some of the most entertaining and striking things which are to be gathered from the discoveries of science. He hopes that his pages will excite inquiry after larger treatises on the same interesting subjects.

The elementary works which the Author has seen, are either too diffuse or expensive, or the calculations are suited to mature age, or they have not been sufficiently simple or entertaining; or, whilst the pen of genius has been lavish in praise of the works of the adorable Creator, he has been studiously concealed from the view of the reader.

Should a single youth rise from the perusal of the following little work, with enlarged con-

ceptions of the wisdom, goodness, and grandeur of God, the writer will rejoice that he has not employed a few of his leisure hours altogether in vain.

PREFACE

TO THE AMERICAN EDITION.

The Directors of the Western Sunday School Union feel assured that they are doing a grateful service, by presenting to the public an edition of the following work. It has ever been an object dear to their hearts, to contribute towards the refinement and elevation of the youthful mind, and in the performance of this pleasing duty, they have seldom felt higher pleasure or greater hopes of success, than they now feel in recommending these "Conversations" to the young.

Utica, March 1, 1828.

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INTRODUCTION.

Mr. Newmrach, was an excellent and pious gentleman, who resided in the beautiful vale of Evesham. He had a pretty cottage on the sea coast in Hampshire, at which he was accustomed to spend the summer months.

After he had been married about two years, his lady died, leaving him a lovely boy, whose name was Frank. His father, who was almost overwhelmed by this painful bereavement, withdrew in a great measure from society, and devoted himself to the welfare and education of his infant charge.

Frank was a fine little boy; and of a very amiable temper, which was a great comfort to his Father, but chiefly to himself; for bad tempered people are never happy. His father found much pleasure in walking with him, in the fine fields, or by the sea-side, when the usual lessons of the day were finished.

Thus thirteen years passed away very happily; and Frank learned the first principles of science from his affectionate teacher. Though the children of a neighboring family used to visit him sometimes, yet he

was always best pleased with his Father's company, and loved it more than any other.

It was in a visit to the cottage which Mr. Newmarch occupied in the summer, that a near relative put on paper, for the instruction of the rising generation, some of those important and useful things, of which Frank and his Father were accustomed to converse.

CONVERSATION I.

OF MATTER.

You said, Father, that you would tell me, what we are to understand by the word, *Matter;* will you do so now?

Yes, Frank; it is a very good opportunity. Matter, is a term which we use to describe every kind of substance. Learned men have written much on its varied and wonderful qualities

Will you tell me some of the principal of them, Father?

Certainly, Frank; I am glad that you make inquiries of this kind. You know, that I have often told you, that the way to become wise, is to ask about every thing which we do not understand.

The *divisibility* of matter, Frank, must necessarily strike every one, who reflects at all. When we walked through the copse the last evening, you was delighted with the fragrance of the honey suckles; that was a specimen, and a very sweet one too, of the divisibility of matter. All the particles of fragrance of which you were conscious, were actually divided from the flower.

I never thought of this before, Father,

though I so much love flowers, and especially the sweet honeysuckle.

Perhaps not; yet you see, that it must be so, or you could not smell it. A pound of gold might be so extended as to cover a wire which would surround the globe.

This is wonderful: but how astonishing it is, Father, that those little insects, which you showed me the other day through the microscope, should each of them have distinct parts, the same as the larger animals. After looking at them, I learnt the pretty lines which you showed me; and when I see any little creature, I always think of them.

Repeat them, if you can; they afford a very interesting illustration of the divisibility of matter.

FRANK,—

"See! each within its little bulk, contains,
A heart, which drives the torrent through its veins;
Muscles to move its limbs aright, a brain,
And nerves dispos'd for pleasure or for pain:
Eyes to distinguish; sense, whereby to know,
What's good, or bad; is, or is not, its foe."

But, Father, cannot we divide matter till we destroy it?

No: grind a grain or two of sand as much as you please, you do not destroy them; the particles of which they were composed still exist: you have divided, but you cannot destroy them.

But when you burn a piece of wood, it is destroyed, is it not?

No: still I must say, divided, but not destroyed. The several parts of which it was composed, are gone off into other forms, but they are not annihilated; that is, they do not cease to be. There is not a single particle of matter less or more now, than there was at the creation of the world.

Things then may be changed, Father, but they cannot be destroyed.

This is the truth, Frank. But a second quality of matter, is *impenetrability;* by which is meant, that every body fills a certain space equal to its bulk, and which no other body can fill.

Is this true, Father? When the tea cup appears empty, is it not so? Is it full of air? And when the tea is poured into it, does it displace the air, and fill up its room?

Yes; but still though the air be displaced from the tea cup, it occupies another space equal to its bulk. You are now by me; but if you run to yonder gate, you will displace the air near it; but still, both you and the air will occupy a space equal to your bulk, or size.

I understand you, Father. I see, that substance of every kind is substance; and, of course, it must, unless you could destroy it, have a place.

Extension, is a third quality of matter; by which we mean, that it exists in different figures and forms, which are long or broad, or of various shapes.

That, Father, is evident, from ourselves, and the trees, and rivers, and fields, and creatures, and the heavens, and the sun, and the moon, and every thing.

It is. As you understand this part of the subject also, I will mention a fourth quality of matter, its *inertia*,—or, the resistance which it makes to any change of state. A stone cannot put itself in motion; and if it be put into motion, it is unable to stop itself.

But it is soon stopped.

It is; by the resistance of the air, or some other cause: it does not stop itself, and it did not put itself in motion; and indeed, it never could have done this. It is true, that matter does move; but it is equally true, that it is not by its own power; It is God who gives it motion.

A fifth quality of matter, is *attraction*. There are two kinds of attraction; the first is, *the attraction of cohesion;* without this, every thing around us would crumble into pieces. I will break this bough; there, I have destroyed the attraction of cohesion, which united it together, just in the place where I have broken it.

When I broke the China cup, sometime ago, Father, then I destroyed the attraction of cohesion.

Yes; and when we saw the plumbers melting their lead at the new house yesterday, they destroyed the cohesion of the particles of metal by fire.

But, Father, can you tell me how this is?

Yes; heat expands every object, and thus it separates the particles of the hardest metals from each other, and melts them: it is thus, that water, when it boils, expands, and flies away in steam.

Then, Father, when we say, that any thing is hard or soft, do we mean, that the attraction of cohesion is greater in the hard than in the soft substance?

Certainly. Every object you behold, illustrates the doctrine of the attraction of cohesion. This is also the case with *the attraction of gravitation;* by which we understand, the tendency of all bodies to each other. This we constantly witness, as things are always falling to the ground.

Do you know, Father, how rapidly any body falls to the ground;

Yes; sixteen feet in the first second of time; three times sixteen in the next second; five times this distance in the third second; seven times in the fourth; and so on regularly, till the body reaches the earth.

When I drop my marbles, do they fall to the ground by the attraction of gravitation?

Yes; and this is the reason why things stand firmly on the earth in every part of the globe. There are people you know in the islands of the great Southern Ocean, and animals, and rivers, and other things, the same as there are here; and though they are opposite to us, yet on account of the attraction of gravitation, they are as secure as ourselves.

That is, because every thing naturally falls, or gravitates to the earth.

Certainly: and this gravity acts on bodies, in proportion to the bulk of matter which they contain. Thus a ten times greater force operates on a weight of ten pounds, than on a weight of one; so, all bodies which fall from an equal height, fall with the same swiftness.

How, Father, with the same swiftness?

Yes, if there should be nothing to intercept either of them.

But the top of this sea-weed, which does not weigh an ounce, and a pound weight, could not come to the ground at the same moment, Father, could they?

No; because the sea-weed presents a broader surface to the air; and so it meets with more resistance than the pound weight.

But would they fall at the same instant if there were no air?

Yes: I will show you, some day, how a feather and a sovereign fall to the bottom of the receiver, from which I have pumped out all the air. Indeed, if there were two weights, one of five pounds, and the other of ten, could you not draw the one of ten pounds to you, in the same time as the weight of five ?

Yes, if I were to exert in reference to the ten pound weight twice the force.

This, Frank, is what the earth actually does.

But what is it that makes the earth attract other bodies, Father ?

You have asked me, Frank, a hard question ; I cannot tell you: no one can tell you. It is a remark of Dr. Price, that every well informed man knows, that the simple question, Why does water run down the hill ? is one which cannot be fully answered.

This subject of matter, Father, is very wonderful.

It is. You have however but just entered on it. We have said nothing about the variety of aspects under which it is presented to us ; and nothing about its perpetual and astonishing changes. The large sledge hammer of the smith, and the anvil on which it strikes, are matter ; so likewise is the sparkling diamond, and the delicate feathers on the wing of a butterfly. The refinement of which it is capable, is most surprising ;

for the air we breathe, and the millions of the rays of the sun, which daily fall on our eyes, are matter. The subject, Frank, is without bounds. There is one remark, however, which is important, and which I much wish you to recollect; it is, that no change, or arrangement, or refinement of matter, can give intellect and thought.—There is no more mind, or thought, in the air, the heat, or the light, than in lead, or iron, or stones. If you add motion, however swift, to matter, it does not produce thought. A cannon ball does not think, though it moves at the rate of four hundred miles in an hour. No accumulation of matter can give thought; a mountain, though it may be very high, and of immense size, does not think. There is no reasoning faculty in the Alps, or the Pyrenees, or in the great globe itself. The human frame too, is material; but there is a "spirit in man, and the inspiration of the Almighty hath given him understanding." God "breathed into him the breath of life, and man became a living soul."

Do you suppose Father, that man has a soul, because he thinks? Do not other animals also think?

They do not reason like man, Frank; of this we are certain; though the subject is not without its difficulties. There are, how-

ever, some broad lines of difference, between the highest of the creatures and man. "The sparrow," says Dr. Johnson, "that was hatched last spring, makes her first nest the ensuing season, of the same materials, and with the same art, as in any following year: and the hen conducts and shelters her first brood of chickens, with all the prudence which she ever attains."

"Surely," adds the same excellent writer, "he who contemplates a ship and a bird's nest, will not be long without finding out, that the idea of the one was impressed at once, and continued through all the progressive descents of the species, without variation or improvement; and that the other is the result of experiments; has grown, by accumulated observation, from less to greater excellence, and exhibits the collective knowledge of different ages and various professions."

It is a fine thing to be able to think, and especially to think well upon a subject, Father.

It is, Frank; it is this, though his body is mortal, which renders him like an angel.

But what, Father, is the leading difference between man and the inferior animals?

Man can discern between right and wrong; he is therefore the subject of God's moral government: the highest order of animals

is incapable of this: an elephant, should he hear the ten commandments repeated ever so many times, would know nothing of their nature; nor could he be made to comprehend the reasons on which they are founded: but every individual of the human race can. Yes, every man has a soul, which must live when the body, which is the tenement it occupies, is broken down, and crumbled into dust; yea, it shall live,

"When every fire,
Of every star, shall languish and expire."

How just then is the sentiment of the great Teacher, It shall profit a man nothing, if he gain the whole world and lose his own soul.

CONVERSATION II.

THE EYE.

FATHER, you said, that you would tell me something that was very wonderful about the eye; will you do so now?

Yes, Frank, I will. Let us walk to the brow of the hill, and bid farewell to the fine prospect from it; in a day or two I intend to take you to the cottage in Hampshire. And as the sun is about to set, and the evening is very fine, we will sit down, and talk of the wonders which God has wrought.

I should like to know all about the eye, Father.

So you shall, Frank; but you must copy my drawings of the different parts of it; then, with the remarks I shall make, I think you will have a pretty good acquaintance with the subject.

How quickly the eye-lid moves, Father.

It does; it is a natural curtain, which is drawn in an instant to exclude danger. It also wipes the eye, keeps it clean, and distributes all over it the moisture necessary for its welfare.

But the eye itself moves, Father.

Yes, it does; upwards or downwards. ...ien

the right or the left, according to our wishes. There are six muscles, or little instruments which regulate its motions.

If any of these should be hurt, Father, what should we do?

Our sight, of course, would be very imperfect. I have read the works of an author, who says, that he knew a gentleman, who enjoyed good general health, but the two little muscles which lift up the eye-lid had lost their power of action; so, when he looked at any object, he was obliged to push up his eye-lids with his hands. How much are we indebted every moment to the goodness of God, for preserving the health of the most inconsiderable parts of the human frame.

How thankful we ought to be when we are quite well! But did you not say, that the eye grows smaller or larger in different situations?

The pupil, or the middle of the eye, does expand or contract, according to the degree of light which there is around us. The other evening, when we were enjoying the twilight in the parlour, and John brought in the candles, don't you recollect, that you said that the light pained you?

Yes, Father; but it was unpleasant only when the candles were first brought in.

True; and the reason was, the pupil of

the eye soon adjusted itself to the light which was around you; and then you became easy.

Was that it, Father? I did not think how it was.

I suppose not. Many persons who are grown up to manhood, little think, how wonderful the different parts of the human frame are.

When the little gnat got into cousin Charles' eye, you know, Father how much he suffered: and yet the light is always coming into them, and it does not hurt us.

So it is; the light not only does not pain us, but it affords us great pleasure. The fly however, which pained Charles so much, though it was but a small one, was more than a million times bigger than a ray of light.

I cannot think how it is, that the objects we see are really drawn on the eye; it seems impossible; but did you not say so, Father?

I did. There is spread all over the bottom of the eye a delicate net-work; it consists of a beautiful expansion of the optic nerve. Impressions of things are conveyed by this nerve to the brain; and the rays of light pass through the pupil, and paint the figure of any object which we see upon it.

You showed us this the other day, when

the butcher brought the eye of a bullock; you cut off the three coats from the back of it, and held it up to the window; and the figure of the casement was on the paper you held behind it.

It was.

But it was upside down, Father: and are objects drawn the wrong way upwards on our eyes?

So you see, it appears, Frank.

How is it, then, that we never see things upside down?

It is difficult altogether to account for it. There are very many things, Frank, which no one fully knows: the works of the great God are unsearchable. But look around you, what do you see?

St. Paul's, and the Thames, and the fine bridges over it, and the shipping, and houses innumerable; I see the whole of London, and the country all around it, to a vast distance.

You do; the view here comprehends an area of some hundreds of miles; it is a sublime prospect.

And how delightfully it glitters with the beautiful rays of the setting sun!

It does.

You said one day, Father, that we could not see any object, unless the rays of light flowed from it to our eyes.

Of course you cannot.

Do the rays of the sun then, come to my eyes from St. Paul's, and from the Thames, and from all the innumerable objects which I now behold?

Undoubtedly.

How wonderful! But the same rays of light which enter my eyes, do not enter the eyes of the gentleman a little beyond us, though he is looking at the same prospect, do they?

O no; thousands of millions of rays are every instant sent forth from St. Paul's to all the multitudes of persons who are gazing on it.

And yet, Father, there is no confusion.

True, there is not; if a thousand persons were here, every eye would see St. Paul's distinctly.

But how is it, that rays from so many thousand thousand objects can find admission through the small pupil of the eye?

I cannot altogether tell you.

You said Father, that you would tell me something wonderful, and this is truly so.

There is, however, a more astonishing circumstance, Frank, which you have not yet noticed.

What is that, Father?

It is, that all this vast landscape, that all this immense assemblage of objects, should be all accurately drawn on the net-work at the bottom of the eye.

And is it so, Father? This is wonderful!

The painter, who drew the miniature of your Mother, is a man of great genius and talent; but do you think, that he could draw a tenth part of this magnificent landscape, with all its brilliant coloring, on a space not larger than the nail of my thumb?

Impossible!

See, what impossibilities the adorable Creator is bringing to pass every moment! Here is the finger of God! Unspeakably delicate must be the strokes of that pencil which is held by the divine hand!

They must, indeed!

And there is another circumstance, which is very remarkable; it is, the ease with which the eye adjusts itself to behold objects, whether they are near, or whether they are distant. It is in vain that we should use the telescope, to examine the fine parts of a leaf, or flower, or any thing that is near at hand; and equally vain would it be, to employ the microscope, to command the most distant part of this magnificent prospect.

It would.

But the eye adjusts itself in an instant, to any distance. It examines objects which are a few inches from us, like the microscope; and, when we wish it, it becomes a telescope, and brings to us an accurate likeness of the distant landscape.

"A ship" says Reid, requires a different trim for every variation of the direction and strength of the wind; and if we may be allowed to borrow that word, the eyes require a different trim for every degree of light, and for every variation of the distance of the object, while it is within certain limits. The eyes are trimmed for a particular object, by contracting certain muscles, and relaxing others; as the ship is trimmed for a particular wind, by drawing certain ropes and slackening others. The sailor learns the trim of his ship, as we learn the trim of our eyes, by experience. A ship, although the noblest machine that human art can boast, is far inferior to the eye in this respect, that it requires art and ingenuity to navigate her; and a sailor must know what ropes he must pull, and what he must slacken, to fit her to a particular wind: but with such superior wisdom is the fabric of the eye, and the principles of its motion contrived, that it requires no art or ingenuity to see by it. Even that part of vision which is got by experience, is attained by idiots. We need not know what muscles we are to contract, and what we are to relax, in order to fit the eye to a particular distance of the object."

The more, Father, you talk about the eye, the more surprising it appears. I never before thought of all this.

I suppose not, Frank ; and this is the case with many people who are much older than you are. I have, however, but just entered on the subject. I have said nothing on the "parallel motion of the eyes ; by which, when one eye is turned to the right or left, upwards or downwards, or straight forwards, the other always goes along with it in the same direction. We see plainly, when both eyes are open, that they are always turned the same way, as if both were acted on by the same motive, force ; and if one eye is shut, and the hand laid upon it, while the other turns various ways, we feel the eye that is shut turn at the same time, and that whether we will or not. What makes this surprising is, that all anatomists say, that the muscles which move the two eyes, and the nerves which serve these muscles, are entirely unconnected. It would be thought very surprising, to see a man, who from his birth, never moved one arm, without moving the other in the same manner, so as to keep them always parallel: yet it would not be more difficult to find the cause of such motion of the arms, than it is to find the cause of the parallel motion of the eyes, which is perfectly similar."

But, Father, I wonder you don't know how this is ; you know almost every thing.

You are very much mistaken, Frank ; we

may reasonably expect many of the works of the great God to be far beyond our comprehension.

It is a very pleasant thing to have good eyes; and, as you often say, to use them as we ought.

Yes, Frank, to use them as we ought, is indeed a continual feast.

It is said in the Psalms, Father, that we "are fearfully and wonderfully made."

Indeed we are; every part of the human frame displays the handy work of the Creator.

And his goodness too, Father.

Yes, he must be good, who gives me so much enjoyment every time I open my eyes, and gaze around me. How much the blind are to be pitied!

It is surprising, though, Father, how blind Betty in the cottage on the common finds every thing around her by feeling.

Yet how superior is sight! How could a blind man acquire an accurate knowledge of such a building as St. Paul's, by touch?—Or how could he form an accurate judgment of this magnificent landscape? A blind man, by feeling, could never find a path through the immeasurable ocean, or sail round the globe, or trace out its shape, or survey its kingdoms; much less could he examine the heavens, and measure the distances of the stars.

This would indeed be impossible, by feeling, Father; the arms which should reach to the stars must be very long.

By the eye, too, we may often give a very shrewd guess, as to the real temper and disposition of our fellow creatures; deceit is often unmasked by the eye; a blind person would be lost here.

It is wonderful, Father, to think of the different kind of eyes. Now there is the little mite, we saw through the microscope, he has eyes, but he cannot see farther than a little part of an inch before him.

True; and perhaps Newton is but a mite contrasted with an angel.

Should we be so happy as to reach heaven,—and nothing, but our wilful rebellion against the good God can shut us out of it, —perhaps, our organs of vision will be, in some unknown and inconceivable way, immensely superior to what they now are.

That is a delightful thought, Father; I should like to have eyes by which I could see the people in the moon, and all the fine landscapes there. Do you think that this will ever be the case?

It is not impossible, that in a better state, we may be enabled to see distinctly much farther than the moon. It is said in the Scriptures, "Eye hath not seen, nor hath

ear heard, nor hath it entered into the heart of man to conceive, what God hath prepared for those who love him."

CONVERSATION III.

OF ANIMALS.

You said, Father, that you would talk more fully about the living creatures, which are on the face of the earth.

I will now. Let us go for a walk, and we shall find some of the subjects of our conversation.

Are not some plants very much like animals?

Indeed they are, Frank; the vegetable and the animal kingdoms approach very near to each other. It is sometimes difficult to say, where the one ends, and the other begins.

One should think, Father, that the sensitive plant in our garden, knew that we touched it; how it shrinks in an instant!

It does; but still, in general, the difference is very great between plants and animals. Plants are stationary, animals move where they please.

The number and variety of animals, Father, appear to be very great.

They do; and there is a beautiful chain, or gradation, in the animal world, from the little creature which the eye cannot discern, up to man; and from him perhaps, to the

highest angel which lives and exults in the divine presence.

But man is the principal animal in the lower creation.

Assuredly; and he makes all the other creatures subservient to his interest.

In Thomson's Hymn, Father, which you gave me to learn, he says of man, that he is "at once the head, and heart, and tongue" of the creation; and the poet calls on him to crown, with his homage, the general song of praise.

He ought to do so; but, alas! he does not. God complained of his ancient people, that they were more ungrateful and stupid than the ox or the ass. If it be reasonable that a servant should serve his master, it is much more so, that man should serve the Being who formed him, and who supports him every moment.

Are not animals divided into five classes, Father?

They are often thus divided; but [illegible] us, of whom I have often told [illegible] ranged them more scientifically [illegible] recollect what the [illegible]

Quadrupeds, birds, [illegible] fishes, insects and reptiles.

QUADRUPEDS, are a large and useful [illegible] of animals; they have all four feet, as the name intimates; they bring forth their young

alive, and suckle them. There is a great variety in this class of animals. There is the porcupine, which is covered with quills; and there is the seal, which has fins, as well as four feet: how different are these from the horse or the cow.

And are they not formed, Father, according to the situations in which they are to live, and the way in which they are to get their food?

They are; the pig and the mole have long anp sharp snouts to turn up the ground, in search of roots which they eat. The lion has a thick strong jaw, to break in pieces the bones of his prey. The dog has a thin long nose, that he may trace the object of his pursuit at a considerable distance. The teeth and the stomachs of quadrupeds also, are suited to their respective habits. This is likewise the case with their legs and their feet. The legs of the elephant were, no doubt, formed to bear its massy weight; and those of the deer and the hare, it is equally evident, fit them to escape from their enemies by flight.

And the claws of the cat, Father, to seize on the mice or the rats.

True, Frank; things could not have happened thus by chance. His hand who is infinite in wisdom, is every where displayed. But what did you say was the next class?

BIRDS, Father.

Yes ; and these are more in number than quadrupeds. And how admirable is their clothing! All the power in the world could not have formed a feather. What a warm garment is that of a bird, and yet how light! Near the skin, the feathers consist of fine down ; those employed in flight, are strong and hollow, that they may be light and suited to the purpose.

And birds, Father, have a little vessel of oil, to rub over their feathers, to keep them smooth, and to prevent the rain from penetrating into them ; I often see the fowls in our yard, and our canary bird, spreading this oil.

This is a wonderful provision; and the fowls which live much in the water, have a large supply of it. These also have webbed feet, to enable them to swim ; whilst other birds have feet which enable them to cling to the branches of the trees.

The nests of birds, Father, are very surprising.

They are, Frank ; that of the wren, which we noticed in our late walk, was very beautiful, and a large building too, for such a little creature ; and how suitable, since she lays a great number of eggs, and her body is so small, that it will not cover them all at once.

The rook's nest, which was in the tree the storm rooted up in the park, was not warm, and it was all made of little bits of stick.

The rook is a large bird ; it lays but four or five eggs, and these she can readily keep warm.

How many eggs, Father, does one of our hens lay ?

I can't tell you, Frank ; I believe though, that if a hen should have plenty of food, she would lay nearly one hundred. This is a very kind appointment of Providence, that whilst birds of prey produce only a few young in a season, those which are useful to man, bring forth a large number. But let us notice your third class.

Amphibious Animals, Father, or animals which live both on the land, and in the water.

Generally, they are of little, and many of them of no value to man ; as the alligator, the frog, the otter, the river horse, and some others.

But the fourth class, Fishes, Father, are of the greatest service.

They are ; they furnish through all the year an abundance of wholesome and palatable food. It is a perpetual harvest, provided immediately by God, without the care of man ; he has only to reap the abundant

treasure. The fins of the fish are as wings to them, with which they fly through the mighty waters; and many of them so swiftly, that they can easily get before a vessel in full sail. Their numbers are, in a very high degree, astonishing; let us only notice one instance, though many others of a like kind might be easily named; pilchards are often so numereus on the coast of Cornwall, that they are not only eaten and salted, but are sold at a very low rate in vast quantities to manure the ground.

But Insects and Reptiles, are the most numerous of all the varied tribes of being. One class is destitute of wings; a second, have two; a third, have four; and a fourth, have wings, and spring from worms; and a fifth class is more wonderful than all the rest, it has the power of self-multiplication; I refer to the Polypi. If one should be cut into twenty pieces, each piece would become a separate and perfect animal.

This is indeed astonishing, Father.

It is. Insignificant as these little creatures appear, insects are often very formidable; you have seen the cattle running wildly and in great anguish, goaded on by an insignificant fly.

I was reading about the locusts in the little book you gave me, and there it is said that in the east they darken the sun. There

run the whole country, and eat up every green thing.

They were one of the plagues of Egypt, and a dreadful plague indeed they must have been. With what infinite ease God can chastise a guilty people!

But what can be the use, Father, of such immense quantities of flies?

I cannot altogether tell you. In general, they furnish food for many of the creatures, which are beneficial to man; they also seek out and devour, every thing of a putrid and offensive nature; they are the scavengers of creation. No doubt they are serviceable in some way or other; perhaps as much so as the cochineal insect, which furnishes a rich crimson dye, if we were fully acquainted with them. God is too wise to have made any thing in vain. The smallest no less than the greatest, display his power, wisdom, and goodness, and suggest many inquiries to which no satisfactory answer can be given.

CONVERSATION IV.

THE NUMBER OF GOD'S WORKS.

You were pleased with the sermon this morning, were you not, Frank? You were very attentive.

I was, Father; yet I wish Mr. F. had said more on one part of his subject.

To which do you refer?

After he had quoted his text, he said that the works of God are innumerable; I wish that he had illustrated this part of his subject.

The remarks he made were judicious; it is impossible to bring all we might wish into one discourse. He amply proved his principal point, that wisdom is displayed in all the works of the divine hand.

But the text, Father, says, that they are *manifold*, as well as made in wisdom.

And so they are; and can't you illustrate this part of the subject yourself?

With your aid, Father, perhaps I can.

Well, let us try. First, examine what is within the earth on which you tread; can you tell me what is to be found there?

I should not have thought of those, Father, though there are a great many. There is the soil on its surface: and gravel, for

our walks; and clay, to make bricks with; and sand to make glass with; and stone for bridges, and houses; and marble, for chimney pieces; and limestone; and coals, to dress our food, and to keep our rooms warm.

There are, indeed, all these, and many more which you have not named.

O, I forgot the metals, and the minerals; let me see, how many of these are there? There are, gold, silver, copper, iron, tin, sulphur, and zinc, with which you made the pretty tree in the glass the other day.

And you have now forgot salt, and quicksilver, and antimony, and many others; and you have overlooked all the precious stones; diamonds, and rubies, and sapphires, and jaspers, and emeralds, and more indeed than I can name; and you will recollect, that these may be but a small specimen of what actually exist, as no one has penetrated far into the earth. Truly, the works of God are manifold.

On the surface of the earth, Father, too, there are mountains, and vallies, and hills, and plains, and forests, and vineyards, and orchards, and rocks, and rivers, and springs, and lakes, and gulphs, and caverns, and seas, and oceans.

More than fifty thousand plants have been classed and numbered by botanists; and

there is reason to believe, that almost every furlong of ground, includes in it some plant peculiar to itself; there are, therefore, doubtless millions upon millions which have never been observed by man.

And, Father, all these plants have different trunks, or stems, and leaves, and fruits, and colors, and scents.

True; there is an immense variety among them; how unlike is the sensitive plant, which shrinks at a touch, and the oak of the forest, which bears uninjured the storms of five hundred or a thousand winters. What a contrast between the pretty moss that grows on our garden wall, and the cedars of Lebanon! between the little rose-tree, blossoming in your Mother's window, and the banyan tree, of which I lately told you, under whose vast shade an army was protected from the burning rays of the sun! Yes, the works of God are indeed manifold.

Yet we have not taken into our account, the animals, and insects, and reptiles, that exist on the face of the earth, nor the creatures which fly through the air.

We have not; though we have reason to believe, from the discoveries of the microscope, that the insect tribes are innumerable. And as ɔɔo ǝɥɐn is three times as extensive as the land, it is not improbable, that the living creatures which are on the land, are as nothing,

contrasted with those which have their abode in the mighty waters. The Psalmist says, that in the ocean, are things creeping, innumerable.

And these again differ in color, and shape, and size, Father.

They do, Frank. And the disproportion, too, how vast, between the mite and the elephant, between the minnow and the whale!

You have not noticed the variety which appears in the human race, Father. No two persons are altogether alike. Cousin Charles and John, who very much resemble each other, are yet easily known apart.

They are. No two voices, perhaps, are precisely the same. The works of God are without number.

And when we look at the milky-way, Father, we are sure that the stars are innumerable.

Of that we are certain, Frank; whatever view we take of the boundless works of the adorable Creator, with what admiration should we exclaim, "O Lord, how manifold are thy works! In wisdom hast thou made them all! The earth is full of thy riches."

CONVERSATION V.

THE SOLAR SYSTEM.

WHAT is the reason, Father, that we do not see any stars in the day time? Have they all set, as the sun does in the evening?

No, Frank. If a small candle were placed on yonder hill, which is ten miles distant, at noon-day, do you think that you should see its blaze?

I think not; because the light of the sun is so powerful: but we should see it if it were dark, should we not?

Perhaps we should; and this is the reason why we do not see the stars in the day-time; their lustre is lost in the superior glory of the sun: so, when he is set, they are visible.

See, Father, Jupiter is a great way from the star near which we last saw him.

He is: he, and a few others, are called planets, from a Greek word, which means to wander; because they are always altering their places in the heavens.

But the stars of Charles' Wain, and of Orion, Father, do not wander.

They do not; they are fixed stars, or suns; they do not roll around our sun, nor do they derive any light or heat from his influence. The planets, or worlds, which do, belong to what we call the Solar System.

Will you tell me Father, all about it?

I cannot do this, Frank; I will tell you some few things; I know but little myself. The sun is in the middle of it. He is a magnificent object.

How then is it that he sets and rises, if he be in the midst, Father.

Properly speaking, he does not either rise or set.

But we constantly see him do so. Are we not to believe what we see?

Not always, Frank. You recollect when you went with me in the coach to see your uncle, you thought the hedges and fields were going along, whilst we were sitting still.

They seemed to do so, Father; but we know that this was not the case: it was the coach which was in motion.

So, when in the steam packet, you thought that the shore and the trees were moving. You see, that in both these cases you were obliged to call your judgment into exercise.

Are you sure, then, Father, that the sun does not go round the earih?

It is evident, Frank, that it does not. If it does, then all the innumerable stars in the heavens must move along with him every twenty-four hours. This is not credible. Besides, the sun is so vast a body, that we cannot suppose that this is the case; it is about 880,000 miles in diameter. How, much,

Frank, is this larger than our globe? I think you can easily answer this question.

Why, it must be one hundred and ten times the diameter of our earth.

And do you think, Father, that any one can live in the sun?

Most likely it has its inhabitants. We see that this is the case with every leaf and little plant; and it is highly probable, that such an immense globe is not destitute of animated existence.

How can any thing live, Father, in so much light and heat?

I cannot tell, Frank. Herschel supposes that the brilliant light around the sun is the solar atmosphere, and by no means forms the body of the luminary. He thinks that the spots on the sun, as they change, and become greater or smaller, and sometimes disappear altogether, are evidently openings in this atmosphere, through which the sun himself is seen.

We are sure, however, Father, that we should have no light or heat, if it were not for the sun.

Certainly not; nor any of the beautiful colors which every where charm the eyes; indeed, without the cheering rays of the sun, nothing could exist on the face of the globe; every plant and flower would fade and die; and every creature that moves and breathes would expire.

What a blessing is the sun, Father; how ought we to thank God for his rays!

Yes, we ought; light is one of those mercies, which, as a sacred writer expresses it, are "new every morning."

Did you not say, Father, that the sun is distant from us about ninety-five millions of miles?

Yes, Frank; yet, in about eight minutes, his light visits us every morning. But who can comprehend what we mean by ninety-five millions of miles? Suppose there was a road to the sun, and that a horse could gallop two hundred miles in a day; how many years would he be going to it?

I must first learn how far he would go in one year; must I not, Father?

Yes.

Let me see; 200 multiplied by 365, the days in a year, is 73,000. And 95,000,000 of miles, the distance between the earth and the sun, divided by 73,000, gives the number of years; and see, Father, it is 1300! A horse, then, that would gallop two hundred miles in a day, would be 1300 years in going to the sun. What a distance it must be!

You are right. We are however, but just entered on the Solar System. You have carefully read, I hope, the account in the volume I lent you.

Yes, Father. MERCURY is the planet which

is nearest to the sun. He revolves around him in eighty-eight days. He is much smaller than our earth. His diameter is about 3200 miles. He is so near the sun, that he is usually lost in the brightness of his rays. The author says, Father, that water would be kept perpetually boiling on its surface.

Yet, near as he seems to the sun, he is distant from him thirty-seven millions of miles. It has been supposed, that if the heat which falls on Mercury fell on the earth, that it would turn every drop of liquid into vapor, and, indeed, burn up the whole world.

The sun must appear very large and glorious to the inhabitants of Mercury, Father, as they are so near it.

It must appear full seven times as large as it does to us. No doubt, from the wisdom which we see every where displayed in the works of God, we may rationally conclude that those who reside in this planet have constitutions suited to their situation. But which is the next planet which rolls around the great orb of day?

VENUS, Father, is the next. She is a fine planet; there she is! How beautifully she shines! She goes round the sun in 224 days, which form her year. She is nearly as large as the earth; her diameter is 7,700 miles. She is the brightest and most beautiful of the stars.

How far is she from the sun?

About sixty-eight millions of miles.

The EARTH, with its beautiful MOON, are the next objects in the Solar System which revolve around the sun. The Earth performs its course in about 365 days. It is ninety-five millions of miles from the sun. The Moon is her bright, her perpetual attendant. She turns round the earth in twenty-seven days and eight hours; she is the nearest to us of all the heavenly bodies. Her diameter is only 2,180 miles. It is 240,000 miles distant.

Our Earth, Frank, is a moon to the moon; but it appears to the people in the moon, thirteen times larger than the moon does to us. From an examination of it through the telescope, it appears probable that there are rivers, and mountains, and lakes in it. Its light is deliciously soft and sweet; but that of the sun is two hundred thousand times greater. But which is the next planet in our system?

MARS, Father; and he is longer in going round the sun than our globe: he is one of our years and ten months on his journey.

He has a larger orbit or circle to travel, as he is farther removed from the sun than our earth: he is distant 145,000,000 of miles. He moves in his course at the rate of 55,000 miles an hour. He is 50,000,000 of miles from us, when he is nearest the earth, and about 240,000,000 of miles when he is far-

thest removed. He is known from the other planets by his ruddy appearance. When nearest to us, he appears larger than at other times; I think, about twenty-five times larger.

Do you think the people in Mars can see our globe, Father?

Yes, and it appears to them sometimes as a morning, and sometimes as an evening star.

JUPITER, Father, is the next planet in our system.

This is not quite accurate, Frank; four very small planets, named Ceres, Pallas, Juno, and Vesta, have been discovered between Mars and Jupiter. It is very singular, their orbits cross each other; the orbit or path of Ceres crosses the orbit of Pallas; and the orbit of Vesta crosses all the other three. Astronomers have supposed, I think without sufficient ground, that these planets are only fragments of a mighty world which has been dashed to pieces. But what have you learnt about Jupiter? He is a remarkable planet.

He is the largest planet in the Solar System; he is 89,000 miles in diameter; he travels more than 28,000 miles an hour.

He is fourteen hundred times larger than our earth, and fifteen hundred times larger than Venus.

He is four hundred and ninety millions of miles distant from the sun, and goes round him in about twelve of our years. He has

three belts, or dusky stripes, around him, and sometimes more.

Herschel has seen his whole surface covered with them.

He has four moons, Father.

The motion of light was ascertained by the eclipses of these moons. If we could see Jupiter from his nearest moon, he would appear a thousand times larger than our moon.

What a fine object he would be, Father! How I should like to see him! I should never forget the sight.

And so should I, Frank; but I was going to remark, that Jupiter has no inclination of his axis; he revolves on it in an upright position, in ten hours; so that his days and nights are always five hours long.

Then, Father, has he any change of season? You said that the change of our seasons was owing to the inclination of the earth's axis.

True; Jupiter can have no change of seasons; there must be perpetual summer at the equator, and perpetual winter towards his poles.

SATURN revolves around the sun next beyond Jupiter; he is known by his pale dead light; he never appears arrayed in the brilliancy of Jupiter. His diameter is nearly eighty thousand miles long; he is more than nine hundred millions of miles from the sun; he is but little less than thirty of our years going

round him. He travels more than twenty thousand miles in an hour; he has also seven moons and two rings: my book does not say, Father, whether the rings ever touch the planet; do they?

No; they are thirty thousand miles distant from any part of it. The largest of them, which is seven thousand two hundred miles broad, would readily include more than four hundred such worlds as ours. The inner ring is twenty thousand miles broad; the open space between the two rings is two thousand eight hundred and thirty-nine miles: and yet they accompany Saturn round the sun, and are never out of the place which God has assigned them.

Milton, Father, when viewing the works of God, calls them "glorious;" he might well say so, might he not?

Yes; and with what infinite propriety does he add: "THYSELF—how wondrous then!" How are they to be pitied, who can gaze on creation, and see nothing of its adorable Author!

Are these rings, by reflecting their light on the planet, as a compensation for his great distance from the sun?

This may be one of their uses; and his moons are evidently for this purpose. The rings, however, may answer ends with which we are unacquainted.

HERSCHEL, Father, is the remotest planet in our system.

So far as we know, Frank; it is the last which has been discovered. Saturn, a few years since, was thought the last.

Herschel is eighteen hundred millions of miles from the sun. What a distance! I should not like to live there; it must be very cold.

We are not sure of this, Frank; God may create warmth, if it be necessary, in many ways of which we have no conception.

He is about thirty-five thousand miles in diameter. He travels fifteen thousand miles an hour. He is eighty-three years and a half in going round the sun. There are six moons revolving round him. But as he has only been discovered a few years, how can any one know how long he will be going his course?

Easily; because we know how far he has to travel; and if we know how great a distance he has gone in twenty years, of course he will go the same distance in twenty more, and so on.

I do not understand how you know that Mercury and Venus revolve in orbits between our earth and the sun.

I will tell you; they are never seen in opposition to the sun; when in the morning the sun is in the east, they are never on the west-

ern side of the heavens; when the sun is in the west, they are never in the east.

You have never shown me Herschel, Father. I should very much like to see him.

No; he is not a star of the first magnitude, and his distance is so great, that he is seldom seen by the naked eye. I will show him to you some fine evening through the telescope.

And I cannot think how you find out the distances of the planets from the sun, by being acquainted with that of the earth.

Listen, Frank, and you shall hear; Kepler, a celebrated astronomer, discovered that the times which the planets take in revolving round the sun, are proportional to the cubes of their distances from the sun.

I scarcely understand you, Father; but will you tell me how you know the distance of Mercury from the sun?

Why, easily; by the rule of three: the earth is 365 days in revolving around the sun; Mercury is 88 days; and the earth is ninety-five millions of miles from the sun: so, the question may be stated thus; as the square of 365 days is to the square of 88 days, so is the cube of 95,000,000 to a fourth number; which, of course, is easily found by the rule.

And does it give you the distance of Mercury from the sun?

No; but the cube root of that number will give you the true answer.

I could easily calculate this, Father.

I am sure you could; it is very easy.

But there are COMETS, Father, belonging to our system; are there not?

Yes; but we know little that is certain in reference to them.

The account which you gave me, Father, says that the comet which Sir Isaac Newton saw in 1680, was two thousand times hotter than red hot iron; was it so, Father?

I cannot tell, Frank; I know nothing of a heat so stupendous as this: much deference, however, is due to the calculations and opinions of this great man.

And Sir Isaac also says that it moved at the rate of 880,000 miles an hour.

The tails of some comets have been thought more than forty millions of miles long. But you shall read more about the subject when you are older.

But, Father, you have said nothing about the fixed stars.

They do not belong to our system; I have shown you the pole-star, and you know how to find it; and you know most of the constellations.

I always think of you, Father, when I see the pole-star; and I recollect, as you told me, that when I am looking at it, I am looking towards the north; the south is behind me; the east is on my right, and the west, of course,

on my left hand. But I should like to hear more about the fixed stars.

We know but little about them, Frank; they are innumerable; for example; more than two thousand have been counted in the constellation of Orion.

But why do they call them fixed, Father? Do you not often show me them rising and setting?

Yes; the whole heavens appear to be in motion from east to west.

Appear to be in motion! Did you not the other evening bid me stand still, and look at Arcturus, in contact with the end of our cottage? And did we not soon find that the star had made evident progress towards the west?

This is true, Frank; but you forgot that I told you that we were, with the earth on which we stood, moving from west to east; and that this made the fixed stars appear as if they were moving from east to west.

But the pole-star, Father, does not even appear to revolve. How is that?

Because the point of the earth, called the pole of the globe, always points to it.

How can you measure the distance between one star and another?

By the celestial globe; there the heavens are divided into three hundred and sixty degrees. From the point over our heads, which we call the zenith, it is ninety degrees to the hori-

zon on every side. The most northern of the three stars in the belt of Orion, is directly over the equator; therefore, from that to the polar star, it is just ninety degrees.

We have reason to believe that the fixed stars are suns, around which systems of worlds revolve. Herschel is of opinion that our sun is actually one of the stars belonging to the milky way. So great is the distance of the fixed stars, that a cannon ball, moving twenty miles in a minute, would be eighteen hundred thousand years going to the nearest of them.

But light, Father, travels swifter than a cannon ball; you said that it travelled twelve millions of miles in a minute; its rays, then, would not be long in reaching the nearest of the fixed stars, would it?

Longer than you would suppose; it would be full three years before it would reach it.

How amazing are the works of God! How true it is, as the Psalm you gave me to learn expresses it, that "The heavens declare the glory of God, and the firmament showeth his handy work."

They do, indeed; especially to the eye enlightened by science. I am always reminded, when I look at the skies, of the sublime reflection of the same beautiful writer: "When I consider the heavens, the work of thy fingers, the moon and the stars which thou hast

ordained; Lord, what is man, that thou art mindful of him! or the son of man, that thou visitest him!"

And if the stars are suns, and have worlds revolving around them, why, Father, the worlds which God has made must be innumerable. How the thought expands the mind, in reference to the power, the wisdom, the goodness, and the grandeur of God. How delightful it is, Father, to think of such things!

It is. Indeed, Frank, such contemplations gratify the mind, which loves what is vast and infinite. So great is the magnitude and immensity of the divine works, that, "were the sun," (I use the words of Mr. Addison,) "with all the host of planetary worlds that move about him, utterly extinguished and annihilated, they would not be missed by an eye that could take in the whole compass of nature, more than a grain of sand upon the seashore. The space they possess is so exceedingly little, in comparison of the whole, that it would scarcely make a blank in creation."

CONVERSATION VI.

THE POWER OF GOD.

FATHER, you said one day, that there was a sentiment in the creed which was thought very plain, and yet no one had ever fully understood it. What was it?

That God is Almighty.

But does not that mean that he is all-powerful?

It is easy, Frank, to say, "I believe in God Almighty;" but no one can conceive the full meaning of the sentiment. No one can have an adequate idea of the power of the Most High, even as displayed in the little world in which we live.

I think, Father, that I can; the world is eight thousand miles in diameter; that is, directly through it, and twenty-five thousand miles round it.

It is; and it is easy to talk of eight, and of twenty-five thousand; but a very different thing to have just conceptions of the real magnitude of this immense body. Let us examine the surface of the earth; it contains about two hundred millions of square miles: have you any idea at all equal to this vast extent of country?

I don't know; I think I have, Father.

But I do not think so, Frank. How far does our prospect reach from this eminence?

You said it was forty miles.

Well, let us suppose, that looking on every side, we can cast our eyes over about five thousand square miles. This is a vast tract of country, and we can view it but very indistinctly; there are villages, and towns, and streams, and rivers, and a multitude of houses, which we cannot see at all. How many such views, think you, must we take, before we could see all the globe? They are more than you imagine, Frank.

I don't know, Father.

Well, divide two hundred millions by five thousand.

O, I can do that; there are 40,000 five thousands, in two hundred millions.

There are: this prospect, then, of forty miles every way, including, as we suppose, five thousand square miles, is but the forty thousandth part of the surface of the globe. How small a part, and how imperfectly it is seen.

Well, this is a surprising calculation! To form a just idea of the surface of the earth, we must see forty thousand such prospects as this! What a thought! How vast are the works of God!

And what must be the power that made such a world! and made it two out of nothing! and recollect, we have been talking only of its sur-

face. If a man were to walk only sixty miles a day, he would be almost ten thousand years, before he could survey every part of it.

And you have not noticed what the earth produces, Father; nor the millions of millions of creatures that live upon it.

True, Frank; nor the inexhaustible mines, which are to be found in its internal parts.—We have reason to believe, that the globe, with the exception of some caverns, of no importance in the estimate, is a solid body. And yet it is upheld every instant by its adorable Creator.

We should think him a strong man, Father, who should take St. Paul's into the air on one of his fingers!

We should, indeed, Frank. What is he then, who "measureth the mighty waters in the hollow of his hand. Who weigheth the mountains in scales, and the hills in a balance; who taketh up the isles, as a very little thing; who hangeth the earth upon nothing."

And yet, Father, this is not the only world which God has formed; for he has made a great many.

True, Frank; we have reason to believe, that the worlds which he has created are without number. We know, also, that some are so large, that the one in which we live, is as nothing to them.

As nothing to them, Father!

Yes, as nothing to them. The planet Jupiter is the largest in our system. It moves round the sun at the rate of twenty-nine thousand miles an hour. It occupies twelve of our years in performing his revolutions about the sun. The diameter of our earth is eight thousand miles; but that of Jupiter is eighty-nine thousand miles; that is, full fourteen hundred times larger that our earth.

Then there is the sun himself, Father.

Indeed, this is an immense body; more than five hundred times larger than all the planetary worlds together; and considerably more than a million times larger than our globe.

To what a vast distance the influence of our sun reaches! You showed me lately the planet Herschel, which you said was eighteen hundred millions of miles from the sun, and yet he distributes color, and light, and heat, and fertility to it, and to the six moons which revolve around it.

How surprising! But I was most astonished and pleased, Father, with the ring of Saturn, which you showed me the other evening.

It is a grand and beautiful object; it is more than nine hundred times larger than our world.

And did you not say that one of his rings was 200,000 miles in diameter, or across it?

Yes; but it is difficult to conceive fully of an object which is so vast.

But is not the moon, Father, about two hundred and forty thousand miles distant from the earth? You said so one evening, I recollect.

Yes; what then?

Well, then, Father, the ring of Saturn would fill up nearly all that space.

It would; that is a striking thought, Frank, and a fine illustration: and so we can form a very just idea of the size of the ring of Saturn.

But you said that the stars were suns, Father.

There is every reason to believe that they are, and that they have all worlds, very many worlds, rolling around them: with the naked eye, on a fine evening, we can see at least a thousand stars.

Then there must be a thousand systems of worlds, Father!

Certainly.

How wonderful! What must he be, who formed them! His power must be without any bounds.

Yes, he is "The Father Almighty!" You can now repeat this sentiment with new feelings, Frank. Yet you have still but a very low idea of the greatness of his power. Where the eye cannot see a star, there are often thousands to be seen by a good telescope. The milky way is bright with their glory.

Are there none beyond the milky way, and beyond what we can see with the telescope, Father?

You have asked me a hard question, Frank. Perhaps what we know of creation is as nothing compared with that which we do not know. I am rather of opinion that there is no space in which there are not worlds which God has made, and beings to declare his praise. It is not to be supposed that a little creature, like man, "who dwells in a tenement of clay," can even see any thing like the limits of his boundless empire, whom the heaven of heavens cannot contain!

In the Psalm you read this morning, it is said that God spake, and the world came into being: what! Father, did God make our globe with a word?

Yes; he spake, and it was done; he commanded, and it stood fast! And not only did he thus make our world, but all worlds: "by the word of the Lord, were the heavens made; and all the hosts of them, by the breath of his mouth." But there is no end of the divine glory!

I cannot think, Father, how the world is held up in the air, and hangs upon nothing; or how it rolls along of itself round the sun. One should think so large a body would never move at all.

The subject cannot be fully explained. It

is a perpetual display of the almighty power of God. It is He who has made worlds without number; it is He who guides them through the heavens; and it is this blessed Being, who every instant sustains the countless multitude of creatures which inhabit them. Surely, none by searching can find out God!

Mercury, I believe, Father, travels faster than any other planet in his course.

He does; he revolves at the rate of 105,000 miles in an hour. How far does he travel in a minute?

Let me see; I must divide 105,000, by 60; because there are sixty minutes in an hour.—Then he must fly along at the rate of 1750 miles in a minute!

He must; and you may well say, *fly* along; for this rapidity has been reckoned two hundred times swifter than the motion of a cannon ball. A cannon ball too, is of no size, compared with the planetary worlds.

What inconceivable power, Father, it must be that moves them! Would it not be delightful to be so near to Saturn, as to have a full view of his beautiful rings.

The sight must be very sublime; it is indeed impossible fully to conceive of its grandeur. And who can estimate the power which is every moment in active operation through the wide universe?

I do think you are right, Father, in your

judgment, that there are but few people who have any thing like a proper idea of the almighty power of God.

Yet, we should muse on his power and goodness. We should supplicate his favor; it is the one thing needful. If he blesses us, we must be blessed. We should never despair of his aid; he can help and deliver us in the utmost extremity. He is indeed "able to do exceedingly abundantly beyond all that we can ask or think. We should gaze on his glorious works, till the hallowed fire of devotion kindles in our bosom, and we are impelled, with holy admiration, to give utterance to the language of the happy spirits who live in his immediate presence, and who see him as he is: "Great and marvellous are thy works, Lord God Almighty! Just and true are thy ways, thou King of Saints!"

What a blessed day, Father, will that be, when we shall really join their happy society, and really unite in these immortal strains!

CONVERSATION VII.

WATER.

The Tide is just coming in; we will walk down, Frank, along the beach.

That will be very pleasant, Father, as the evening is so warm.

How useful is water; without it, the earth would soon become a vast desert: and how abundantly has the adorable Author of all good bestowéd this great blessing upon the world.

And what a multitude of creatures, Father, live in the water, and none can live without it.

True; every being and object which has life, would die without water: it refreshes and cleanses the whole world.

And how useful it is, Father, in promoting intercourse with the most distant countries of the globe.

It is; they are easily visited in our ships. A great part of the wealth of nations arises from commerce, by means of the ocean. Water, indeed, is in the highest degree useful, in all its forms.

In all its forms, Father! Is not water, then, water?

Yes; and it is eight hundred times heavier than air; but it very commonly becomes light-

er than the air we breathe; indeed, water is composed of two kinds of air, which chymists call oxygen and hydrogen.

Water lighter than air, Father!

Yes; look at those clouds, which are gently moving around the horizon; of what are they composed?

There is rain in those clouds, I think; and yet they float in the air; but they could not do so, if they were not lighter.

Certainly not; the sun raises them from the mighty ocean, the vast fountain which supplies the whole globe. And God commissions his winds to scatter them abroad, that they may enrich every part of the wide creation.

See, Father, the steam vessel is coming up the channel.

It is; there, Frank, water changes its form, and becomes a powerful instrument in the hand of man. The application of steam to useful purposes may be yet in its infancy.

Here, Father, water assumes a form which is lighter than air, or else it would not rise up into it.

True. What an immense process is perpetually going on in creation: the sun draws up the vapors from the ocean; they rise into the air in clouds; the winds scatter them; they are intercepted by the mountains; they dissolve; they form springs; the living creatures partake of them; the gentle showers

fall, and refresh and fertilize the earth; the springs unite, and form rivers, which return again into the sea. Well might the Psalmist exclaim, "O Lord, how manifold are thy works! In wisdom hast thou made them all! The earth is full of thy riches!

How wonderful evaporation is, Father.

It is. If we could not prove it unanswerably, but few would believe, that the waters of the ocean could be made to float through the atmosphere; yet, so it is. It is thus that God "waters the hills from his chambers; the earth is satisfied with the fruit of his works."

Do you know, Father, how much lighter the vapors are, than the waters of which they are formed?

About fourteen hundred times. Without evaporation, nothing could be dried. There would be no stacks of hay or of corn. Without evaporation, the clothes of your play-fellow who fell into the river the other day, could never have been dried again.

And a shower of rain, Father, would then have spoiled our dress at any time.

It would. It is, indeed, difficult to conceive how we could have had any clothing. But God has arranged every thing in infinite wisdom and goodness, and for the benefit of his creature man.

It would be pleasant, Father, to know how much water such a river as the Thames pours every day into the ocean.

Dr. Halley has made a curious calculation on this subject; he thinks that it must be about two hundred and three millions of tons.

How is it, Father, that the sea is so salt?

It is probable that there are immense mines and mountains of salt in the great deep.

You told me that the saltness of the sea was the principal reason why it did not freeze to any extent.

It is. There is a circumstance well worthy of notice, in reference to our rivers; the air mingles with the water during the process of freezing, so that the frozen waters expand, and they become lighter than they originally were.

I have often wondered, Father, how it is that ice should swim; but this makes it very plain.

It is well that it does swim. If it were heavier than the water, one quantity after another would sink to the bottom of rivers, till the mass of water would be frozen, and the heat of summer would be unable to dissolve them; so that there would not be a river in our country.

This again, Father, shows the wisdom and goodness of God; does it not?

Assuredly; and so do the tides which are now dashing their billows against the beach: they not only tend to purify the ocean, but they waft into the port, the vessels which are

laden with the treasures of foreign lands; and then, when they ebb, they bear out those which are laden for foreign countries.

But how is it, Father, that the waters thus ebb and flow?

It is from the attraction of the sun and moon; but principally from the influence of the moon, as she is so much nearer to the earth than the sun. The tides occur about twelve hours and three-quarters from each other. The moon has the greatest attractive influence when on the meridian.

But you told Charles, Father, the other day, that it was not high water till three hours after the moon had passed the meridian.

I did; and it is so. This arises from that property of matter which I named to you, by which it would continue in the same state.

Will you explain the Spring and Neap tides to me, Father?

I will, Frank; the spring tides happen at the times of the new and full moon: at the new moon, the sun and the moon attract in the same direction; and when it is full moon, the influence of the sun is but little in opposition to that of the moon. The Neap tides, are at the first and last quarters of the moon; then the sun raises the water, where the moon depresses it; and depresses it where the moon raises it. The tides are highest, on the middle of the earth's surface: because the attraction

of the sun and moon are principally on this part of the globe. What a sublime idea does a Sacred Writer give us of the blessed God, when he says, that he holdeth the mighty waters in the hollow of his hand!

But what is most delightful, Father, is, that this great Being will become our Father!

It is; seek, my dear Frank, this first of blessings: it is better than life.

CONVERSATION VIII.

AIR.

WATER, Father, by evaporation, must make a very large part of the atmosphere.

It evidently does; as the clouds, which often cover the face of the heavens, abundantly prove.

Since our last conversation, Father, I have read the account of Dr. Watson's experiment in reference to evaporation. Is it not surprising!

I do not recollect the particulars; can you repeat them?

Here, Father, I have copied the account into my pocket book. Shall I read it?

Do, Frank.

FRANK. "An acre of ground, burnt up by the sun, dispersed into the air sixteen hundred gallons of water, in the space of twelve of the hottest hours of the day. I put a glass, mouth downward, on a grass plot, on which it had not rained for above a month. In less than two minutes, the inside was covered with vapor; and in half an hour drops began to trickle down its inside. The mouth of the glass was twenty square inches. There are 1296 square inches in a square yard, and 4840 in an acre. When the glass had stood a quarter of an hour,

I wiped it with a piece of muslin, the weight of which had been previously taken. As soon as the glass had been wiped dry, the muslin was weighed again: the quantity collected was, six grains, in a quarter of an hour, from twenty square inches of earth; a quantity equal to 1600 gallons from an acre, in twenty-four hours." Another experiment, after rain had fallen, gave a much larger quantity.

This is a pleasing and satisfactory experiment. Does Watson mention how much space an inch of water occupies, when it is turned into vapor?

I think not; do you know, Father?

Yes, Frank; more than two thousand inches.

You said, Father, that water was composed of two kinds of air.

I have separated water into these different kinds of air. The air we breathe, is formed of two gasses, called oxygen and nitrogen. If we were to collect twenty-five measures of common air, about five would be oxygen, and twenty would be nitrogen.

What is the difference, Father?

It is very great; without oxygen, nothing would burn, and nothing could live. A lighted match put into oxygen, burns with great brilliancy; if put into nitrogen, it is as soon extinguished as if put into water; an animal put into it, dies instantly.

It would be a good thing, Father, then if the air were all oxygen.

By no means; God has formed every thing with the highest wisdom. If we were to breathe oxygen only, life would soon become extinct. It would be so great a stimulent, that the human frame could not long sustain it. I saw a young gentleman breathe it the other day from a bladder, but he was very unwell for some days after the experiment, and his life was in danger. To breathe nitrogen alone would be instant death.

Then if God were to take away the oxygen, all mankind, and every living thing would die.

They would. It is necessary to our health, that they should be mingled, as they are, with exquisite skill. Truly, as it is said in Scripture, in God, or by his power and goodness, we every instant, "live, and move, and have our being."

Father, you have not said any thing about the weight of the air; it must have weight, like every thing else. Has it not?

Indeed it has; the mercury in the barometer rises or falls, as the air is heavy or light.

And the air-pump, Father, proves that it has great weight.

Certainly, it does. And we can ascertain the pressure of the air, by the common pump. The weight of the atmosphere supports a column of water of about thirty four feet and a half high. Now the cubic foot of water weighs one thousand ounces, or sixty-two pounds and

a half. What then is the weight of the column of water, which the pressure of the atmosphere balances?

Let me see; that will be thirty-four times and a half, sixty-two and a half; that will be equal to 2158 pounds.

The one hundredth and forty-fourth part of this will be the weight of the air on every square inch. What is it? I am sure you can tell me.

Fifteen pounds.

What a weight it must be, Father, on the whole earth.

It must, indeed. Mr. Cotes made an inquiry on this subject, the result of which was, that it is equal to a globe of lead sixty miles in diameter; which amounts to a pressure equal to five thousand millions of millions of tons.

Does the air press on me, at the rate of fifteen pounds for every square inch of my body? I don't feel that it does, Father.

But it does; and the reason you do not feel it, is, because it is counteracted by the air that is within you. On every square inch there is a pressure of fifteen pounds; on every square foot, then, there will be 144 times as much, or 2160 pounds; and if we suppose, that there are fifteen square feet on a man's body, how much will the weight be? The answer, Frank, I think will surprize you.

That will be, fifteen times 2160; or, 32,400 pounds.

How many tons is this?

Divided by 112, it is 289 hundred; and by twenty, to bring the hundreds into tons, it is almost fourteen tons and a half.

It is. But the higher we rise above the surface of the earth, the air becomes thinner and lighter. I have read of travellers who have ascended some of the highest mountains in South America, and who have found it difficult to breathe on their summits. Had they stayed long on those eminences, they would have expired.

The purity of the air is very remarkable, Father.

It is, Frank. It was necessary that it should be so, for the preservation of health and life. Hence appears the use of winds, and tempests, and storms of thunder and lightning; these constantly promote its purification. The works of God are not only magnificent, but they are worthy of their adorable Creator, as they are all arranged in infinite wisdom and goodness.

CONVERSATION IX.

COLORS.

FATHER, did you not say in our last walk, that colors were accidental, and not essential to bodies?

Yes; and so they are: a body is always of the color of those rays of light which it reflects.

Do colors, then, arise from the light?

Certainly. If there were no light, there would be no colors. You said last evening, as you looked from the drawing room window, that it was very dark; of what color was every thing then?

Black, Father; but that was, because we could not see distinctly.

You can never see any object without light; and then it is colored by the rays of the sun.

But are not the rays of the sun white, or of a light yellow, Father?

No; or else every thing would be of these colors.

But how do you know this?

I will tell you, Frank; here is a triangular glass, which is called a prism. Draw up the shutter for a few moments. Here are a few of the sun's rays, through a little passage which has been left by a nail; I will intercept them with the prism: there,—

Why, Father, there are all the colors of the rainbow on the wainscot. Let me see; there is red, and orange, and yellow, and green, and blue, and indigo, and violet. O how beautiful!

Then, Father, all the colors put together would make white; would they not?

Yes; if you were to take a round piece of pasteboard, and put on the colors in proper proportion, and then turn it round swiftly, it would appear white.

In proper proportions, you say, Father; are they not equal as seen through the prism?

No; divide the figure produced by the prism into 360 equal parts; you will find that the red will fill 45 of them; the orange, 27; the yellow, 48; the green, 60; the blue, 60; the indigo, 40; and the violet, 80.

Every ray of the sun is of a light color, Father; every ray, then, must include all the seven colors; and we should see them all, if we could refract a single ray with the prism.

Certainly; but the rays of the sun are so exquisitely fine, that you could not procure a single ray, on which to make the experiment. But as ten thousand rays, or any number you please, produce the colors of the rainbow, of course, every individual ray must produce them.

How wonderful, Father, it is, that there should be all the colors of the rainbow wrapt

up in every single ray of light! Who can find out the works of God!

It is. Here is the finger of God; here is omnipotence; here is divine wisdom.

And is there not the goodness of God, too, Father, in making creation so beautiful, to delight our eyes and to cheer our hearts?

Assuredly. Every thing might have been of one color; creation would then have lost one of its principal charms. But God's great goodness appears every where.

I want more fully to understand you, Father; you say there is no color without light.

Yes; it is the theory of Sir Isaac Newton.

Then, when the geranium was shut up in the back parlor, whilst we were out last summer, and the leaves all turned white, was that for want of the light?

Certainly. The lettuce which you see every day on the table are white. Robert tied them up, that they might become so.

To shut out the light?

Yes, or else they would have been green; those which are not tied up, you know, are green.

Then why is one object green, and another yellow, and another red, and another violet?

The answer is easy; the rose is red, because it reflects the red rays of light, and absorbs all the other: the grass is green, because it reflects the green rays, and absorbs

all the other; and so on. Paper and snow are white, because they reflect all the rays. My coat is blue; it reflects the blue rays; your cousin's coat is black, because it absorbs all the rays of the sun.

Why do objects change their color, Father? The leaves, you know, do so in autumn.

They undergo an internal change, and no longer reflect the green, but the yellow, or some other rays.

But the flowers of our geraniums are of different colors; how is this, Father, that the same flowers should not be of one color?

Because different parts of the flower reflect different rays of the sun; one part red; another, indigo; a third, the violet.

That seems, Father, as if the parts of the same flower were really different from each other in their texture: I mean, it seems as if there were the qualities of several different flowers in one.

That is the case; good microscopes prove that it is so: this accounts for their reflecting different rays, and for their diversity of colors.

Why, Father, every thing, when explained, seems surprising. But if the black aborbs, or drinks in, all the rays, and the white reflects them, then a black dress must be much warmer than a white one.

And so it is.

I am greatly pleased, Father, with your ac-

count of colors. How astonishing are the rays of light!

They are; and how thankful we should be for eyes to behold them.

We ought, indeed; the blind must lose many enjoyments. Milton very beautifully describes his feelings after he became blind.

Can you repeat his lines?

I think I can, Father.

"With the year
Seasons return; but not to me returns
Day, or the sweet approach of ev'n or morn,
Or sight of vernal bloom, or summer's rose,
Or flocks, or herds, or human face divine;
But clouds instead, and ever-during dark
Surrounds me, from the cheerful ways of men
Cut off; and for the book of knowledge fair,
Presented with an universal blank
Of Nature's works, to me expung'd and raz'd,
And wisdom, at one entrance, quite shut out."

These are very fine verses, Frank, and you have repeated them very feelingly. If light be so wonderful, what must He be who formed it? A sacred writer says of him, that he is light, and that with him there is no darkness at all.

Yes, Father, and another says, that he dwells in light inaccessible!

CONVERSATION X.

THE EARTH.

We have taken several views of the world in which we live, which are interesting and instructive There is one, however, which I regard as of very great importance, which I have not named.

What is it, Father?

It is what is called Geology, or an account of the different strata, or layers of substance, of which the earth is composed.

But you cannot go far into the earth, Father, to know what they are.

Of course, I mean, so far as we can ascertain the materials of which it is formed. From unquestionable evidence, it appears that the earth has undergone an immense revolution: according to the Scriptures, the waters of the ocean have covered the whole earth, even the tops of the highest mountains. There are, indeed, many proofs, on the earth itself, that this has been the case. God has written, and in very plain characters, too, the truth of his word upon his works.

The Bible says, you know, Father, that "the foundations of the great deep were broken up."

Yes, and mountains doubtless became plains, and plains and vallies became mountains; and some islands were lost in the immeasurable ocean, and others were formed.

You pointed out the common strata to me, the other day, when you showed me the brick and tile manufactory.

Do you recollect what they were?

Yes, I think I do, Father; common soil, clay, sand, marl, chalk, and stony ground.

This uniformity, however, is by no means general: the strata varies in different places. But whatever view we take of the earth, of its gravel, or marble, or coal, or chalk, or stone; whether we go into the deep vallies, or ascend the highest mountains, we find shells, and sea-plants, and petrified fish of different kinds. The hills and the mines in foreign lands, as well as those of our own, present similar articles, and in greater abundance. The Alps, and the Apennines, the Pyrenees, and the vast mountains in South America, give evident proof that they have been visited by the ocean. Indeed, the productions of America have been found in a fossil state in Europe, and those of Africa in Germany.

Can you mention some of them, Father?

Yes; fossil specimens of the mouse deer, a native of America, have been found in

Ireland; and the crocodile, a native of the Nile, has been found in Germany. The traveller Humbolt met with vast quantities of sea shells on the Andes, 14,120 feet above the level of the sea.

This is indeed surprising, Father. No one could have carried them thither, I should suppose.

Certainly not; they are found in such immense quantities, that this could not have been the case. Geologists, or persons who have devoted their leisure to the examination of the internal structure of the globe, have found the peculiar productions of the four quarters of the world, in a fossil state, in one place.

Have they found any thing which does not now exist, in their researches?

Yes; the fossils of many animals now unknown, have been found, though it is possible that they may exist in some unexplored parts of the world.

How many of this kind have been discovered, Father?

I think, more than thirty. I will mention two or three; there is the Irish Elk, a large species, which has been found in the quarries of England and Ireland, of the Isle of Man, and in those of France, and of Germany.

On the banks of the Ohio, in America,

there are found many remains of an animal called the Mastodon. It had tusks like an elephant, and appears to have been as large. I think you saw the bones of the Mammoth, when we were at Bristol, did you not?

Yes, Father; it must have been a prodigious creature.

Do you recollect its size, Frank?

No, Father; but the man said that it was much larger than any elephant which had ever been seen.

It was, though I forget its exact dimensions. I have read of one, whose head weighed four hundred and fourteen pounds.

Will you tell me, Father, of some instances in which the earth itself has evidently been disturbed by the revolutions which it has undergone?

Instances are very numerous. An eminent Geologist says, "That our whole country has been evidently convulsed. All the known strata, to the greatest depths that have been explored, have been more or less broken or displaced; and in some instances, have been so lifted, that some of the lowest of them have been raised to the surface; whilst portions of others, to a very considerable depth and extent, have been entirely carried away." I have actually visited some of our coal mines, at an immense depth in the earth, in which there

are what the miners call *Faults;* which are nothing but immense disruptions of the strata.

Fetch me, Frank, the Supplement to the sixth volume of the Encyclopedia Brittannica: I folded one of the leaves down near a remarkable passage on this subject, the other day.

Here it is. "Mount Meisner, in Hesse, six miles long and three broad, rises about 1800 feet above its base, and 2100 above the level of the sea, overtopping all the neighboring hills, for forty or fifty miles round. The lowest part of the mountain consists of the same shell limestone and sandstone which exist in the adjacent country. Above these are, first, a bed of sand; then a bed of fossil wood, one hundred feet thick at some points; and the whole is covered by a mass of basalt, five hundred feet in height. On considering these facts, it is impossible to avoid concluding, that this mountain occupied, at one time, the bottom of a cavity, in the midst of higher lands. The vast mass of fossil wood could not all have grown there, but must have been transported by water from a more elevated surface, and lodged in what was then a hollow. The basalt, which covers the wood, must also have flowed in a current from a higher site; but the soil, over which both

the wood and the basalt passed, has been swept away, leaving this mountain as a solitary memorial to attest its existence.

"Thus also, on the side of Mount Jura, next the Alps, where no other mountain interposes, there are found vast blocks of granite, some of a thousand cubic yards, at the height of more than two thousand feet above the lake of Geneva. These blocks are foreign to the rocks among which they lie, and have evidently come from the opposite chain of the Alps; but the land which constituted the inclined plane, over which they were rolled or transported, has been worn away, and the valley of lower Switzerland, with its lakes, now occupies its place. Transported masses of primitive rocks, of the same description, are found scattered over the north of Germany which Von Buch ascertained by their characters to belong to the mountains of Scandinavia; and which, therefore, carry us back to a period when an elevated continent, occupying the basin of the Baltic sea, connected Saxony with Norway."

This account is very interesting, and, indeed, delightful. Many people would have gone by these rocks and mountains, and would not have thought of their history.

True, Frank; there are thousands of persons who live near them, and who have seen

them from their infancy, who know nothing of it. There are wonderful objects to be seen almost every where, if we will but use our eyes and our understandings. You have been reading Barrow's Travels in Africa: did you notice, as I wished you, what he says of the immense mountains near the Cape of Good Hope?

Yes, Father. He gives a particular description of them; and he says that the strata of which they are composed, is not "placed in the order of their specific gravity: the whole formation of them," he says, "clearly points out, that a grand revolution has taken place on the surface of the globe which we inhabit."

This, I think, Frank, is incontrovertible. The researches of almost every day, and in every part of the world, add new proofs to those which we already possess on this remarkable subject.

But, Father, did not the account you read of the mountains from the Encyclopedia, mention primitive rocks? Are there different kinds of rocks?

Certainly. Geologists divide rocks into four classes. The first are called *Primitive Rocks*. No animal or vegetable remains are to be found in these; indeed, they appear not to have undergone any alteration since they were originally formed. Another class

are called *Secondary Rocks;* traces of animals and shells, are generally, more or less, to be found in all these. *Alluvial Rocks* are the third class. These are generally loose in their quality, and have no very solid texture. The fourth class are *Volcanic Rocks.* As their name imports, they are produced by volcanos. You shall read more about these another day.

How evident it is, Father, that God has written, as you said, the truth of his word upon his works.

It is. The ocean has been over what is now the dry land. A deluge has evidently covered the earth, according to the doctrine of the Scriptures.

What a Being is God! The Psalmist says, "He looketh on the earth, and it trembleth!" And how awful must he be in his displeasure.

Yes, Frank, he must: it could not have been a light thing which induced him to send a deluge on the earth; to break up the fountains of the great deep, and thus to destroy the works of his own hands. His anger must be terrible; but "his favor is life, and his loving-kindness is better than life."

There is every reason, Father, to hope in his goodness.

There is, Frank: we know that "his

tender mercies are over all his works." "He desireth not the death of a sinner, but rather that he turn and live." All who seek his mercy shall assuredly find it.

CONVERSATION XI.

THE HUMAN FRAME.

We have conversed about the heavens, and the sun, and the moon, and the stars, and many other things, Frank; let us now talk of a subject more interesting and wonderful, at least to ourselves.

More interesting and wonderful than the stars and the heavens, Father! why, what can it be?

The Human Frame, Frank; for it is a very wonderful piece of mechanism. Man is, doubtless, the first of the creatures; and he was formed to have dominion over the earth, and over every living thing. He, alone, of all the animals which God has formed, is erect in his posture. He touches the ground only with the extremity of his body. With a glance of his eye, he surveys the vallies, and the hills, and the stars of heaven. He, alone, arranges the heavenly bodies which revolve in the immensity of space, in order, and understands the revolutions of the globe on which he lives.

We are sure, Father, without thinking much on the subject, that man is a wonderful creature. You have told me, you know, Father, about the eye; I don't think,

though, that you noticed then how admirably it is situated to guide the whole body.

The wisdom and goodness of God are seen in giving us two hands and two eyes. I was in company lately with a person, who, many years since, lost one of his eyes; he said, however, that he had not much missed it, as the other had been all that was absolutely necessary. I met a man yesterday, who had but one arm; this, however, was of the greatest service to him. If God had given to us but one arm or one eye, if this had been lost, all would have been lost. But he has given to us (O, how great are his wisdom and goodness!) two hands and two eyes.

What a surprising instrument the arm is, Father.

It is, Frank. At once strong and light, it is capable of performing every useful motion. It bends inwards and outwards, upwards and downwards, and in whatever direction its owner pleases. The human hand has done many and great things: among other objects, it has built large and beautiful cities.

And great ships, Father, in which we may sail round the world in which we live; and surprising things, more than one can readily mention.

And how beautifully does the skin cover

the whole body! It is a fine net-work, woven with divine skill, by God's own hand.

The teeth, too, are very remarkable, Father.

They are; the foremost are thin and sharp, to cut our food asunder; and the hindmost are broad and strong, to grind it to pieces.

And hearing, too, Father, is a delightful faculty.

It is. Every part of the human frame is wonderful.

Do you understand every thing, Father, about the human frame?

O no, Frank; there are many things which I do not comprehend.

Will you tell me what these are, Father?

I do not understand how it is, that by sounds coming through the air, ideas are communicated to the brain. I do not understand how, when I choose to take a walk, by the act of my will I communicate motion to my body. I do not understand how my heart keeps perpetually beating, and throwing the vital current through my whole frame, whether I am awake or asleep; and, of course, without any care of mine. It has been well remarked, that the vessels which take the blood from the heart to every part of the system, resemble the numerous water-pipes which supply a

great city. It is altogether an incomparable piece of machinery.

But you know, Father, that the veins are pipes to take the blood back again to the heart.

They are. And when I consider the slight materials of which the arteries and veins are composed, I do not comprehend how it is that this wonderful apparatus works, night and day, at the rate of one hundred thousand strokes every twenty-four hours, for seventy or eighty years together, without a moment's intermission, and without the least weariness.

And you have often remarked, Father, that we cannot comprehend the union of the soul with the body.

True, Frank; no one can describe how the mind is united with the body.

And, Father, how wonderful is the sense of tasting; and how surprising is the gift of speech, by which we make known our wants, and all the inmost sentiments of our hearts.

It would take a long time, Frank, to relate all the wonders which are evident in the human frame. The poet Cowper beautifully compares it to "a harp of thousand strings," which is constantly kept in tune by the gracious hand which first formed it.

No hand but his, Father, could keep it in tune a single moment.

True, Frank. The heavens and the earth, the sea and the dry land, present innumerable wonders to the contemplative eye; but, in some points of view, we find in the human frame, "diviner wonders still." And yet we have only referred to the body: the mind is the noblest part of man; it is this which distinguishes and exalts him above all other creatures; and of this we have said nothing.

But some of the creatures, Father, exhibit extraordinary instances of sagacity. You often admire our Pompey on this account; and then, there was the elephant which we saw among the collection of wild beasts; you said that you was very much astonished at all he knew and did.

I was. But none of the animals are for a moment to be compared with man: the instances in which he is their superior, are innumerable.

Will you name a few of them, Father?

I will, Frank. Pompey is pleased, on a winter evening, to lie down by the parlor fire. There, you know, in the day-time, he has often slept till the fire has gone out. He never fetches a clump of wood in from the pile, to renew it, when it is low: did you ever see him do this?

No, Father. But don't you think that a monkey would do this?

No, Frank; travellers who have gone through the woods of America, tell us, that when they leave a fire, monkeys and other animals will crowd round it; but none of them perpetuate it by putting on more fuel. We may also remark, that many animals are fond of corn and nuts; yet they never formed a plantation, or sowed any fields. Even the elephant possesses but a very contracted degree of intelligence. For example; he is fond of the sugar cane; he will readily expose his life to procure it; but in the immense territories he occupies, he never formed an acre into a sugar ground, and no one could teach him the art of cultivation.

You remarked, too, the other day, that the animals never make any improvement.

They do not, Frank. The most sagacious of them never make any discoveries. The present generations of cows, or horses, or fowls, do not know any thing more than the first which were created. None of the brute creation ever made a steam vessel, or any thing resembling one. None of them ever sailed round the world, or communicated their ideas and reflections, as our Milton has sublimely done, in his Paradise Lost. O, no. Man has a spirit capable of knowing and loving the blessed God. His

thoughts rise to the heavens; they wander through eternity ; they anticipate a state of unutterable enjoyment, in the blissful presence of God for ever.

CONVERSATION XII.

THE GOODNESS OF GOD.

Bishop Butler, Father, calls the world a "mighty ruin;" does not this seem to take away from God's goodness, since we must regard him as destroying the works of his hands?

By no means, Frank; it affords a display of his infinite love to what is right, of his hatred to what is wrong, and of the awful nature of his displeasure; but it is no proof of his want of goodness. When a magistrate orders a criminal to be punished, no one thinks that he is wanting in goodness; so far from it, that every reflecting mind would regard him as wanting in goodness, if he were not to act in this manner. Would he be good, who should exempt the most abandoned criminals from punishment, and set them at liberty, to destroy the best interests of society?

Certainly not, Father. But is there any proof that God destroyed the former world for its crimes?

Yes: the Bible presents you with manifold proofs of the truth of the assertion. On the very first view of the subject, we might be sure that this was the case. We

know that God is a good and kind Being; we are, therefore, sure that he would not have destroyed any part of his works without ample reason: and what reason can we even imagine so probable, as the inexcusable rebellion of his creatures against his rightful and paternal authority? There is a well drawn comparison, Frank, in Gisborne's Natural Theology, which, if I recollect right, will admirably illustrate my meaning. Fetch me the volume.

Here it is. "Suppose a traveller, penetrating into regions which were unknown to him, suddenly to find himself on the confines of a city lying in ruins. Suppose the desolation to afford manifest proof that it was not effected by the mouldering hand of time, but has been the result of design and of violence. Dislocated arches, pendent battlements, interrupted aqueducts, towers undermined and subverted, while they record the primeval strength and magnificence of the structures, proclaim the determined purpose, the persevering exertions, with which force had urged forward the work of destruction. Suppose farther, that the stranger discovers a present race of inhabitants, who have reared their huts amidst the wreck. He inquires the history of the scene before him. He is informed that the city, once distinguished by splendor, by

beauty, by every arrangement and provision for the security, the accommodation, the happiness of its occupiers, was reduced to its existing situation by the act of its own lawful sovereign—the very sovereign by whom it had been erected, the emperor of that part of the world. 'Was he a ferocious tyrant?' 'No!' is the universal reply. 'He was a monarch, pre-eminent for consistency, forbearance, and benignity.' 'Was his judgment blinded or misled by erroneous intelligence, as to the plans and proceedings of his subjects?' 'He knew every thing but too well; he understood with undeviating accuracy; he decided with unimpeachable wisdom.' 'The case, then,' cries the traveller, 'is plain; the conclusion is inevitable. Your forefathers were assuredly ungrateful rebels, and thus plucked down devastation upon their city, themselves, and their posterity.' The actual appearance of the globe on which we dwell, is in strict analogy with the appearance of such a city."

I see your argument, Father: the globe affords a display of the justice and holiness of God, without being any impeachment of his goodness.

True, Frank; a Being who was not just and holy, could not be good. But have you read Paley's chapter on the divine goodness?

Yes, Father.

Can you mention some of the principal thoughts which are contained in it?

I think I can. He says, that notwithstanding the pain and affliction which are to be found in the world, that, nevertheless, the creation is in a great measure happy. He remarks, that this is the case with the whole insect world. Their sportive motions prove their felicity. A bee among the flowers is one of the most cheerful objects which can be looked on. Its life appears to be all enjoyment; it is so busy and so pleased: yet it is only a specimen of the happiness of the whole. The motions of the fish in the water, and their leaping up out of it, show that they are happy.

Does he not mention a curious instance of fish leaping out of the water?

He does. I wrote the paragraph out in my pocket book. Shall I read it, Father?

Do, Frank; it is very remarkable.

"Walking," he says, "by the sea-side, in a calm evening, upon a sandy shore, and with an ebbing tide, I have frequently remarked the appearance of a dark cloud, or rather, very thick mist, hanging over the edge of the water, to the height, perhaps, of half a yard, and of the breadth of two or three yards, stretching along the coast as far as the eye could reach, and always retir-

ing with the water. When this cloud came to be examined, it proved to be nothing else than so much space, filled with little shrimps, in the act of bounding into the air from the shallow margin of the water, or from the wet sand. If any motion of a mute animal could express delight, it was this; if they had meant to make signs of their happiness, they could not have done it more intelligibly. Suppose then, what I have no doubt of, each individual of this number to be in a state of positive enjoyment; what a sum, collectively, of gratification and pleasure have we here before our view!"

This is a very pleasing display of the happiness which pervades the lowest departments of the creation. We need only open our eyes, Frank, or take a walk, and we shall behold a multitude of objects, which prove that God is good. If we look at the heavens, its magnificence delights us: they, indeed, without language, sublimely declare the glory of God, and the vast expanse displays his handy work. The flowers, adorning, more or less, every season of the year, cannot but gratify us with their beauty and fragrance. The trees, and the shrubs, and the fine colors that distinguish every object; the exquisite carpet which is spread over the face of nature;

the melody of the birds ; the reviving gale ; the cheering sunshine ; and herbs and fruits, which both nourish us and delight our taste; all declare that God is good, and that "his tender mercies are over all his works."

Paley remarks, Father, that the young of all animals appear to receive pleasure even from the motion of their limbs and the use of their faculties, without reference to any end to be answered by the exertion. "A child," he observes, "without knowing any thing of the use of language, is in a high degree delighted with being able to speak. Its incessant repetition of the few articulate sounds, or, perhaps, of the single word, which it has learned to pronounce, proves this point clearly. Nor is it less pleased with its first successful endeavors to walk, or rather to run, (which precedes walking,) although entirely ignorant of the importance of the attainment to its future life. A child is delighted with speaking, without having any thing to say ; and with walking, without knowing where to go. And, prior to both these, I am disposed to believe that the waking hours of infancy are agreeably taken up with the exercise of vision, or, perhaps, more properly speaking, with learning to see."

I believe that the views of this excellent writer are just. It is a gratifying thought,

that the creatures which are in pain and misery are as nothing, contrasted with those which enjoy ease and happiness. At every moment, there are countless myriads of beings which are in the enjoyment not only of comfort, but delight. And even in reference to the afflictions of mankind, we have abundant reason to believe the sentiment of the sacred Scriptures, that "God does not afflict willingly, nor grieve the children of men."

God's great goodness shines in making suitable provision for the immense family of his creatures. If a person should feed a whole town, with twenty thousand persons in it, for a twelvemonth, how great must be his resources! how vast his liberality! Yet, through successive years and ages, God feeds all the innumerable tribes of being, and he does it with infinite ease. What can be more easy than for us to open our hand? With as much ease does God supply the wants of the innumerable family of being. The Psalmist gives us this sublime idea. "These," he says, "all wait upon thee; that thou givest them, they gather; thou openest thine hand, they are filled with good." Only to mention one instance of the vast supplies with which he furnishes his creatures; a shoal of herrings is often more than six miles long, and three broad

A codfish lays in a season more eggs than there are inhabitants in England. We might as soon count the blades of grass which cover the wide creation, as number the creatures which are sustained and fed by him every moment.

Father, how great is his goodness!

It is, Frank: there is no end to it; and it is not the goodness of a day or a year; but it is durable as his everlasting throne, and wide as his immeasurable dominion.

Paley observes, Father, that it is the extensiveness of the Creator's bounty which makes us insensible to it. We do not, he thinks, properly prize what we enjoy in common with mankind in general; yet he remarks that these common mercies are our greatest blessings.

And so they are. Air, and water, and sunshine, and bread, and health; sweet sleep, the use of our limbs, and of our senses, and rational faculties, are among our chiefest blessings, and yet none are more common. And it is but too true, that because almost every one enjoys these, that they do not excite our gratitude as they ought.

You recollect the blight which fell on my cherry tree last spring, Father, do you not?

Yes; what then, Frank?

Paley has given me quite another view

of this subject, to that which I used to entertain; he says that we should regard the blight as legions of animated beings, claiming their portion in the exuberant bounty of nature. Yet I do wish they had settled on some other tree, rather than on mine.

You ought not to wish so, Frank; you had as much fruit as was good for you: why should we grudge these little creatures their pittance, as sufficient is generally left for the use of man?

Paley argues the divine goodness from the pleasure which we have in eating. Eating is necessary to the preservation of our existence, but the pleasure accompanying it is not necessary.

This is a very pleasing thought. If I recollect right, he notices the sweetness of sounds in the same point of view: God might have given us hearing without harmony. The divine goodness is also evident from the faculties of smell and of vision; there might have been smell without fragrance, and vision without beauty.

But, Father, do not storms and earthquakes seem to afford an argument somewhat against the divine goodness?

No, Frank; they convince us that "with God is terrible majesty;" and that he now and then awfully chastises and visits man for his manifold rebellions; yet he has every where

written on his works that he is good. When it is considered that man has offended his Maker, and that a large proportion of our race live perpetually unmindful of his goodness, how astonishing it is that he does not very often punish them, and convince every one of the value of his favors, by withholding them.

If he were like man, Father, he would do so; but he is not.

He is not: this thought affords a very striking illustration of the divine goodness. O, how many are there, who are filled with so much malice, that if they could, they would deprive their neighbors who have offended them, of light, or water, or air. I recollect, in the late contest with France, even a British Parliament, (and there is not, perhaps, a more humane assembly on the face of the earth,) would not allow a supply of bark for the sick and the dying in the French hospitals. If God were to act thus towards those who are practically hostile to his government, how large a proportion of the race of man would be utterly consumed! The world, then, every moment, presents an immense display of the goodness of God, in the continuance of its common blessings. But the greatest, the most munificent proof of God's kindness to a guilty world, is given to us in the hallowed pages of Revelation.

What is it, Father?

It is mentioned in a single verse of St. John's Gospel: "God SO loved the world, that he gave his only begotten Son, that whosoever believeth in him should not perish, but have everlasting life."